

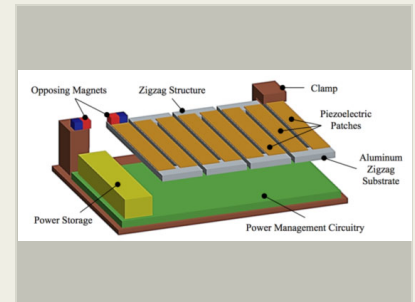
Compact Energy Conversion Module, Phase II

Completed Technology Project (2015 - 2017)



Project Introduction

This STTR project delivers a compact vibration-based Energy Conversion Module (ECM) that powers sensors for purposes such as structural health monitoring (SHM). NASA customers include the Rocket Propulsion Test (RPT) program, the ISS, and the Orion deep space vehicle, all of which need wireless sensors to monitor and assess structural health. The ECM represents a major advancement in the use of wireless and self-powered devices by enabling the miniaturization of vibration-based energy harvesting devices suitable for powering sensors. Implications of the innovation There exist two basic problems in reducing the size of vibration-based harvesters that plague all current commercially available devices—both are addressed here. The first is addressed by eliminating the problem of frequency matching in compact devices. The second is addressed by providing a broadband device capable of energy conversion across a range of frequencies. Technical objectives Our existing prototype is a TRL 5 unit that we used to demonstrate our ability to convert kinetic energy to useful electrical power. This prototype combines piezoelectric beam transducers with artificially induced magnetic fields to force a nonlinear broadband behavior. Phase II uses this approach for compact sizing of low center frequency transducers with the objective of delivering a field-validated compact ECM that provides a near order-of-magnitude improvement over current energy harvesters. Research description Phase I created an efficient prototype and established feasibility. In Phase II we build a fully operational unit and perform field validation-tests compatible with SSC test beds. Anticipated results Anticipated results include a reduction in the amount of battery waste generated by self-powered devices that enables long-term wireless deployment. Phase I completed a TRL 5 prototype and tested its performance in relevant vibration environments. Phase II validates and delivers a TRL 6 unit.



Compact Energy Conversion Module, Phase II Briefing Chart Image

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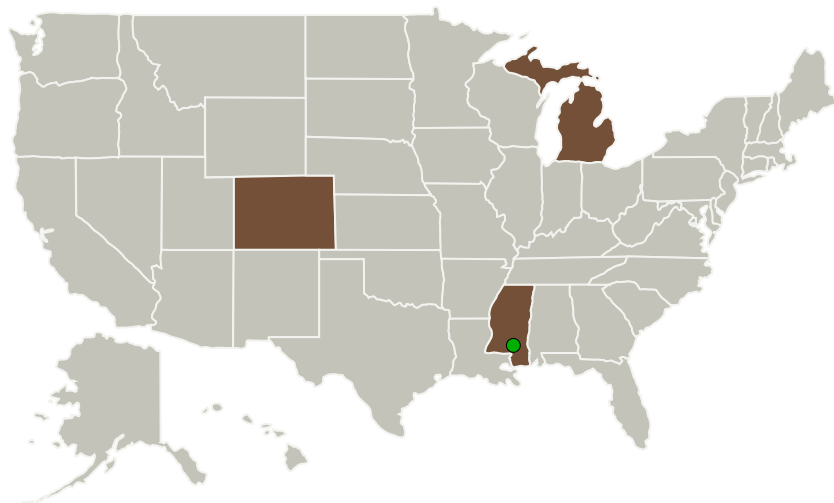
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Extreme Diagnostics, Inc.	Lead Organization	Industry	Boulder, Colorado
● Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Extreme Diagnostics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert B Owen

Co-Investigator:

Robert Owen

Primary U.S. Work Locations

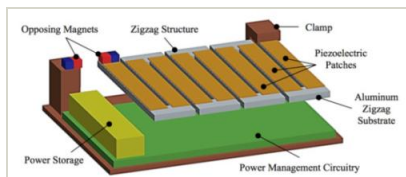
Colorado	Michigan
Mississippi	

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Images



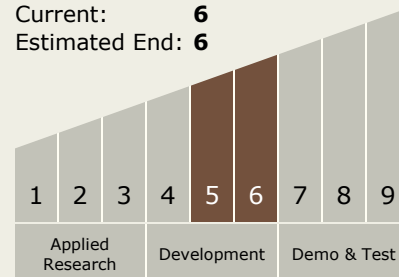
Briefing Chart Image

Compact Energy Conversion
Module, Phase II Briefing Chart
Image

(<https://techport.nasa.gov/image/129529>)

Technology Maturity (TRL)

Start: **5**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System